long as the observer cares to remain at work. Care must, of course, be taken to keep the successive strings of guage papers distinct. This is readily effected by simply marking the first paper on each string with the declination of the central line of the sweep.

Note on the Possible Existence of a Lunar Atmosphere.

By E. Neison, Esq.

Owing to the many difficulties with regard to the constitution of the lunar surface involved in an assumption as to the absolute non-existence of a lunar atmosphere, it would appear of far greater probability that some such atmosphere, however limited, exists. Not only, as Dr. De La Rue has remarked, is it difficult to conceive any chemical formation of matter without an atmosphere; but it is also difficult to even find matter, exhibiting the features and properties of that constituting the lunar surface, which under the known conditions would not either yield an atmosphere, or require for formation the presence of substances that would.

The absolute absence of any atmosphere has never yet been demonstrated, but only the fact that it does not exceed certain limits, generally supposed much more restricted than is actually the case. In consequence, it is usually granted that some atmosphere might exist; it is also assumed that it must be of most extreme tenuity; and the subject is dismissed as a matter of indifference without inquiring where the admission might carry us in so far as relates to this atmosphere's power of fulfilling the same purposes as our own terrestrial one.

But it would be of interest to ascertain how far this possible lunar atmosphere might not effect for the lunar surface those changes, &c., that our own does for the terrestrial surface; and whether, in fact, it might not amply suffice for maintenance of, at least, some form of vegetable life. For the present, however, this must be deferred.

The only point restricting the extent of a lunar atmosphere of the nature supposed, appears to be its refractive power, more especially as shown by the occultation of stars by the Moon. Irrespective of the circumstance that these do not invariably answer conclusively in the negative, it does not appear to be generally recognised, that we may have an atmosphere whose maximum power of refraction would not be equal to one second of arc, and yet be of very considerable amount. For of however great tenuity, in comparison with our dense terrestrial atmosphere, it would be in reality present in large quantity; to be estimated, in fact, with regard to each square mile of surface, by very many thousands of tons.

There can be but little doubt but that such an atmosphere

would exert a very considerable influence on the lunar surface; render possible the existence of many substances that appear to constitute a great portion of that surface; and explain many selenographical observations of great interest, that at present appear to point to some such solution, and thus support the hypothesis of the existence of a definite lunar atmosphere.

10*th June*, 1873.

On the Determination of Longitudes by Moon Culminations.

By Asaph Hall, Esq.

(*Communicated by J. W. L. Glaisher, Esq.*)

The method of determining longitudes by Moon culminations is so simple in theory and so easy of application, that when only an approximate value of the longitude is desired, this method will often be applied. In case, however, we wish an accurate determination of a geographical position, such as may be necessary for a station occupied in observing the Transit of *Venus*, it is well that we should not over-estimate the accuracy of this method. In many of the estimates that have been made we have an illustration of what is frequently happening, viz. the oversight of the existence of constant errors which render such estimates of accuracy wholly illusory. It is customary to determine the probable error of observing the transit of the Moon's limb over a single wire, by comparing the transits among themselves, to do this also for a fixed star, and then by combining these probable errors to determine the probable error of the observed difference of right ascension. Performing this calculation for the two stations, we have, by known rules, the probable error of the resulting longitude; and if our assumptions were correct, we could, by increasing the number of observations, reduce the error of the longitude to as small a quantity as we please. Experiment, however, shows that this is impossible. In nearly all the determinations of longitude by Moon culminations, where a large number of culminations have been observed, the computed probable error of the result is only a small fraction of a second; but the telegraphic determinations of the same points show errors in the old determinations of two, three, and even four seconds of time. Thus the longitude of San Francisco, determined from 206 Moon culminations, was found to be four seconds in error. The most decisive experiment on this point is the determination of longitude between Europe and America. The three determinations of longitude between Greenwich and Washington by the U. S. Coast Survey, by means of the Atlantic cables, give the difference of longitude, $5^h\ 8^m\ 12^s{\cdot}2$. The following are the determinations of the same difference of longitude by Moon culminations: